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Imaging the expression of Channelrhodopsin-2 as a directly light-gated cation-selective membrane channel in HEK 293 cells

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Abstract content
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Channelrhodopsins (ChRs) originated from algae of Chlamydomonas genus have been considered as directly light-gated ion channels. In microalgae, their primary function is to direct the organism towards or away from the light stimulus as well to optimize the light conditions needed for photosynthesis. ChR2 originated from Chlamydomonas reinhardtii was shown to be involved in generation of photocurrents in this green alga has been found to be 10 times better than ChR1 for the expression in most host cells like Xenopus oocytes. Despite of this fact and ChR2 can be easily targeted genetically; many of selective promoters cannot achieve sufficient expression levels of ChR2 for photostimulation. In the present work, HEK 293 cells has been expressed by ChR2 tagged with the fluorescent protein mCherry (ChR2mCherry) in one series of experiments and by ChR2 and mCherry individually in another set of experiments. The results have shown that ChR2 is a directly light-switched cation-selective ion channel upon stimulating the cells with 475 nm blue light. This channel opens rapidly after absorption of a photon to generate a large permeability for monovalent and divalent cations. Furthermore the degree of expression of ChR2mCherry in HEK 293 cells was better than that of ChR2 alone despite the initial thought of being mCherry genes could compete with the ChR2 genes.

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